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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/317,536	05/24/1999	BIN ZHAO	97RSS256-DIV	9245

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EXAMINER
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OWENS, DOUGLAS W

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 12/30/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/317,536

Applicant(s)

ZHAO ET AL.

Examiner

Douglas W Owens

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 10 October 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 16-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28-33 is/are allowed.
- 6) ☒ Claim(s) 16, 19-27 and 34 is/are rejected.
- 7) ☒ Claim(s) 17 and 18 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 16, 19 and 20, 23, 24, 26 and 34 are rejected under 35 U.S.C. 102(e) as being anticipated by US patent No. 6,222,269 to Usami.

Regarding claims 16 and 34, Usami teaches an interconnect comprising:

metal lines (3) with gaps therebetween;

low-k material (5) filling the gaps;

a protective layer (7) directly over the metal lines and low-k material;

a dielectric layer (8) over the protective layer, wherein the dielectric layer has a different composition than the low-k material and the protective layer;

a via in the dielectric layer;

a metal (9) filling the via;

a second metal (10, Col. 7, lines 5-8 and 62-65) layer over the dielectric layer;  
and

an opening in the protective layer for allowing the metal in the via to contact the metal lines.

Regarding claim 19, Usami teaches an interconnect, wherein the protective layer includes a dielectric material.

Regarding claims 20 and 23, Usami teaches an interconnect, wherein the protective layer includes silicon nitride.

Regarding claim 24, Usami teaches an interconnect, wherein the first metal layer is an aluminum alloy (Col. 7, lines 2-10), the metal filling the via is tungsten (Col. 7, lines 54-60), and the second metal layer is an aluminum alloy (Col. 7, lines 62-65).

Regarding claim 26, Usami teaches an interconnect, wherein the dielectric layer is silicon dioxide, the protective layer is silicon nitride, and the low-k material is an organic low-k material.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 21, 22, 25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usami.

Regarding claim 21, Usami does not teach an interconnect, wherein the protective layer is silicon carbide. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use silicon carbide, since it is a known material that is well suited for the intended use.

Regarding claim 22, Usami does not teach an interconnect comprising a spacer on the vertical portion of the low-k material. It is conventional in the art to provide spacers in vias where metal fills are performed for various reasons. It would have been obvious to one of ordinary skill in the art to include a spacer since it is desirable to protect the dielectric material, as well as preventing unwanted diffusion of metal impurities.

Regarding claim 25, Usami teaches an interconnect, wherein the first and second metal layer is aluminum alloy. Usami does not teach an interconnect, wherein the metal filling the via is an aluminum alloy. It would have been obvious to one of ordinary skill in the art to select an aluminum alloy since it is a known material that is well suited for the intended use.

Regarding claim 27, Usami teaches an interconnect, wherein the dielectric layer is silicon dioxide and the protective layer is silicon nitride. Usami does not teach an interconnect, wherein the low-k material is porous silicon dioxide. It would have been obvious to one of ordinary skill to use porous silicon dioxide since it is a known material that is well suited for the intended use.

***Allowable Subject Matter***

5. Claims 28-33 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record does not teach an interconnect, wherein portions of the dielectric material are disposed between portions of the low-k material.

6. Claims 17 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

7. Applicant's arguments filed October 10, 2002 have been fully considered but they are not persuasive.

The applicant argues that Usami does not teach an interconnect comprising "a low-k material filling gaps between metal lines formed from a first metal layer, a protective layer formed directly over the metal lines and the low-k material, and a dielectric layer formed over the protective layer, where the dielectric layer has a different composition than the low-k material and the protective layer". Usami does indeed teach an interconnect comprising (See Fig. 1) a low-k material (5) between metal lines (3), a protective layer (7) directly over the metal lines and the low-k material, and a dielectric layer (8) over the protective layer. The protective layer is positioned directly above both the metal lines and the low-k material since it is not formed above a region adjacent the metal lines and low-k material. The low-k material comprises a material such as organic SOG and the protective layer comprises silicon nitride. Since the dielectric layer comprises silicon dioxide it is clear that the dielectric layer has a different composition than the low-k material and the protective layer.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a low dielectric constant layer in all of the regions between interconnect lines) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

The applicant asserts that an insulating layer (6) is directly above over interconnect lines (3) and the low dielectric layer among other layers. Protective layer (7) is also directly above the interconnect lines and the low-k material.

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W Owens whose telephone number is 703-308-6167. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

DWO  
December 27, 2002

Steven Loke  
Primary Examiner  
